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TETRAFLUOROETHYLENE POLYMERS

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A. This invention relates to new compositions of matter, being polymers of exceptional properties.

B. At the present time there are no totally satisfactory materials for handling certain corrosive agents, such as hydrofluoric acid, or for protecting workers against the fumes which arise from such reagents. Goggles having glass disks are attacked by the fumes, and shortly become unserviceable.

C. It is an object of the invention to provide a new composition of matter which is highly resistant to corrosive influences and to oxidation, and which can be molded and spun and put to a wide variety of uses where its peculiar properties would be advantageous.

D. The objects of the invention are accomplished by the compositions of matter which may be formed by the polymerization of tetrafluoroethylene. Other objects of the invention are accomplished by the process of polymerizing the fluoroethylene herein set forth.

E. I have discovered that tetrafluoroethylene will polymerize at ordinary temperatures when subjected to super-atmospheric pressure. I have also discovered that the rate of polymerization may be quickened by carrying out the polymerization under pressure in the presence of a catalyst. Furthermore, I have discovered that the polymerization of tetrafluoroethylene can be carried out advantageously in the presence of a solvent.

F. The following examples, which are summarized in the table, illustrate but do not limit the invention.

time the unpolymerized tetrafluoroethylene was removed, leaving a residue of 0.6 part of white solid polymer. The yield was 7.1% or a polymerization rate of 0.71% per day.

Example II

Tetrafluoroethylene (7.8 parts) was placed in a container under pressure at 20° C. The yield of polymer after 21 days was 0.05 part or 0.64%.

Example III

Tetrafluoroethylene (7.3 parts) was placed in a container with 0.1 part of zinc chloride, under pressure and maintained at a temperature of 20° C. The yield of polymer after 21 days was 0.1 part or 1.37%.

Example IV

Tetrafluoroethylene (5.4 parts) was placed in a container with 0.1 part of silver nitrate, under pressure at 25° C. After three days the container was completely filled with spongy white polymer. This material was partially polymerized tetrafluoroethylene, and had a very high vapor pressure. Yield of completely polymerized material was 0.05 part or 0.93%.

Example V

Tetrafluoroethylene (6.8 parts) was placed in a container with 0.1 part of silver nitrate under pressure at 25° C. The container was completely filled with partially and completely polymerized tetrafluoroethylene. Yield of completely polymerized product was 0.3 part or 4.4% in 10 days.

Table

Ex- ample	Parts C ₂ F ₄	Time, days	Temp., °C.	Catalyst, and solvent for monomer	Yield, parts	Yield, percent
I.....	8.5	10	25	None.....	0.6	7.1
II.....	7.8	21	20	do.....	0.05	0.64
III.....	7.3	21	20	0.1 pt. ZnCl ₂	0.1	1.37
IV.....	5.4	3	25	0.1 pt. AgNO ₃	0.05	0.93
V.....	6.8	10	25	0.1 pt. AgNO ₃	0.3	4.4
VI.....	7.0	21	25	0.1 pt. AgNO ₃	2.3	33
VII.....	4.0	-----	25	0.1 pt. AgNO ₃ , 2.5 methyl alcohol.....	Jelly	
VIII.....	4.5	3	25	0.1 pt. AgNO ₃ , 2.2 methyl alcohol.....	1.3	29
IX.....	7.4	-----	25	0.1 pt. AgNO ₃ , 3.3 methyl alcohol.....	2.0	27
X.....	8.8	21	25	0.1 benzoyl perox.....	0.05	0.57
XI.....	3.5	-----	50	None.....	-----	-----

Example I

Tetrafluoroethylene (8.5 parts) was placed in a steel cylinder under pressure and allowed to stand for 10 days at 25° C. At the end of this

Example VI

Tetrafluoroethylene (7 parts) and 0.1 part silver nitrate were placed in a container under 55